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B1 P21259.A02

1. Field of the Invention--;

Page 1, after line 16, insert the following:

B2

--2. Discussion of Background Information--;

Page 4, after line 18, insert and center the following:

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--SUMMARY OF THE INVENTION--;

Page 14, after line 9, insert the following:

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--The present invention provides a method for the production and processing of alloyed casting material for a working part of an indefinite chill roll. This method comprises providing a melt having a composition comprising, in wt-%, 2.0 to 3.5 carbon, 1.0 to 2.0 silicon, 0.5 to 2.0 manganese, 1.0 to 3.0 chromium, 3.5 to 4.9 nickel, 0.2 to 2.9 molybdenum, with the remainder being iron, accompanying elements, and impurities related to the manufacturing process. Added to and dissolved in the melt are more than 0.5 and up to 5.9 wt-% of vanadium. The vanadium may in part be replaced, in an amount of less than 0.6 wt-%, by niobium and/or tantalum. The resultant melt is cast into a mold and allowed to solidify into a body, which body is subjected to a heat treatment which comprises heating to a treatment temperature, holding at this temperature, and cooling to room temperature. In this method, the composition of the melt is set using alloying methods by fixing the concentrations of carbon, silicon, nickel and the effective total of the carbide forming elements in such a manner that upon solidification of the melt a microstructure is formed which comprises 1.0 to 3.0 vol-% of graphite. In a metallographic section, more than 20 and

less than 100 graphite particles are present per mm^2 of observed surface. The remainder of the microstructure is composed primarily of martensite, 8 to 35 vol-% of eutectic carbides, and at least 1 vol-% of finely distributed carbides of vanadium, niobium and/or tantalum.

In one aspect of the present method, the mold is a centrifugal casting mold. In another aspect, the body is or is processed into a working or sleeve part of a composite roll comprising a core part and said working or sleeve part.

According to yet another aspect, the body is processed into the composite roll before it is subjected to said heat treatment.

In another aspect, the above microstructure comprises 1.0 to 2.5 vol-% of graphite, A4 more than 22 and less than 100 graphite particles are present per mm^2 of observed surface in a metallographic section, and the remainder is composed primarily of martensite, 10 to 25 vol-% of eutectic carbides, and 2 to 20 vol-% of finely distributed carbides of vanadium, niobium and/or tantalum.

In still further aspects of the present method, the concentration ratio of carbon to silicon in the melt is set to a value of not higher than 2.6, e.g., not higher than 2.0, and/or the carbon content of the melt is set to a value of 2.2 to 3.1 wt-%, e.g. to a value of 2.6 to 2.95 wt-%, and/or the silicon content of the melt is set to a value of 1.2 to 1.85 wt-%, e.g., to a value of 1.4 to 1.75 wt-%, and/or 0.002 to 0.65 wt-% of aluminum, e.g., 0.005 to 0.04 wt-% of aluminum, is added and dissolved in the melt, and/or the nickel content of the melt is set to a value of 3.51 to 4.7 wt-%, e.g., to a value of 4.15 to 4.6 wt-%, and/or the

concentration ratio of molybdenum to chromium in the melt is set to a value of less than 1.0, e.g., to a value of less than 0.8, and/or the concentrations of chromium and molybdenum in the melt are set to values of 1.5 to 1.9 wt-% of chromium and 0.3 to 0.9 wt-% of molybdenum, and/or 1.8 to 3.9 wt-% of vanadium, e.g., 1.9 to 2.9 wt-% of vanadium, is added to the melt and dissolved therein.

According to a further aspect of the present method, subjecting the body to a heat treatment comprises heating from room temperature to a treatment temperature of 400 °C to 500°C, e.g., 460 °C to 480 °C, holding at this temperature for at least two hours, e.g., at least 8 hours, and cooling to room temperature. The cooling to room temperature may be followed by a low-temperature treatment.

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The present invention further provides a casting material for the working area of indefinite chill rolls. This casting material comprises an alloy of, in wt-%, 2.0 to 3.5 carbon, 1.0 to 2.0 silicon, 0.5 to 2.0 manganese, 1.0 to 3.0 chromium, 3.5 to 4.9 nickel, 0.20 to 2.9 molybdenum, 0 to 0.65 wt-% of aluminum and more than 0.5 to 5.9 vanadium. The vanadium may in part be replaced, in an amount of less than 0.6 wt-%, by niobium and/or tantalum. The remainder of the alloy comprises iron, accompanying elements and impurities related to the manufacturing process. Furthermore, 1.0 to 3.0 vol-% of graphite is present in the form of particles with a distribution of more than 20 and less than 100 particles per mm^2 of polished surface of the alloy.

In one aspect of the present casting material, the alloy comprises 1.8 to 4.9 wt-% of

vanadium and 2.2 to 3.1 wt-% of carbon, and 1.2 to 2.5 vol-% of graphite is present in the form of particles with a distribution of more than 22 and less than 90 particles per mm^2 of polished surface.

According to further aspects of the present casting material, the alloy comprises 1.2 to 2.5 wt-% chromium, 0.5 to 2.1 wt-% molybdenum and 1.5 to 4.9 wt-% vanadium and/or the concentration ratio of carbon to silicon in the alloy is not higher than 2.6, e.g., not higher than 2.0, and/or the alloy comprises 2.6 to 2.95 wt-% carbon and/or 1.2 to 1.85 wt-% silicon, e.g., 1.4 to 1.75 wt-% silicon, and/or 0.002 to 0.65 wt-% aluminum, e.g., 0.005 to 0.04 wt-% aluminum, and/or 3.5 to 4.7 wt-% nickel, e.g., 4.15 to 4.6 wt-% nickel, and/or the concentration ratio of molybdenum to chromium in the alloy is less than 1.0, e.g., less than 0.8, and/or the alloy comprises 1.5 to 2.01 wt-% chromium and 0.3 to 0.9 wt-% molybdenum and/or 1.8 to 3.9 wt-% vanadium, e.g., 1.9 to 2.95 wt-% vanadium.

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According to yet another aspect, the casting material comprises 8 to 35 vol-% of eutectic carbides, e.g., 10 to 25 vol-% of eutectic carbides, and 1 to 15 vol-%, e.g., 2 to 10 vol-%, of carbides of at least one of vanadium, niobium and tantalum.

The present invention also provides a composite indefinite chill roll comprising a core part and a working or sleeve part surrounding the core part. The core part is made of low-alloy cast iron and the working or sleeve part has a thickness of 10 to 150 mm and is made of a casting alloy with little tendency to adhere or weld to the rolling stock, has a Shore C hardness of 70 to 90 and comprises 1.0 to 2.5 vol-% of graphite, 8 to 35 vol-% of eutectic

carbides, and 1 to 20 vol-% of uniformly distributed carbides of at least one of vanadium, niobium and tantalum, with the remainder being primarily composed of martensite and constituents related to impurities and the manufacturing process.

In one aspect of the composite indefinite chill roll, the graphite is finely dispersed, with a graphite particle count of more than 20 particles per mm^2 of polished surface in a metallographic section.

In another aspect, the working or sleeve part comprises 1.0 to 2.5 vol-% of graphite, the latter with a graphite particle count of at least 22 but less than 100 graphite particles per mm^2 of polished surface, 10 to 25 vol-% of eutectic carbides and 2 to 10 vol-% of carbides of at least one of vanadium, niobium and tantalum.

p4 According to another aspect thereof, the casting alloy of the working or sleeve part comprises, in wt-%, 2.0 to 3.5 carbon, 1.0 to 2.0 silicon, 0.5 to 2.0 manganese, 1.0 to 3.0 chromium, 3.5 to 4.9 nickel, 0.20 to 2.9 molybdenum, 0.002 to 0.65 aluminum and 0.5 to 5.9 vanadium, with the remainder being iron and impurities. The vanadium may in part be replaced, in an amount of less than 0.6 wt-%, by at least one of niobium and tantalum.

According to still another aspect of the present composite indefinite chill roll, the casting alloy of the working or sleeve part comprises, in wt-%, 2.21 to 3.1 carbon, 1.2 to 1.85 silicon, 0.6 to 1.6 manganese, 3.5 to 4.7 nickel, 0.005 to 0.1 aluminum and 1.8 to 3.9 vanadium.

According to yet another aspect, the casting alloy of the working or sleeve part